

A Pair of Braille-Based Chord Gloves

Myung-Chul Cho*, Kwang-Hyun Park*, Soon-Hyuk Hong*, Jae Wook Jeon*

Sung Il Lee**, Hyuckyeol Choi***, Hoo-Gon Choi**

School of Information and Communication Engineering(), School of System Management Engineering (**)*

*School of Mechanical Engineering(***)*

Sungkyunkwan University

nowwake@ece.skku.ac.kr, shaia@ece.skku.ac.kr, hsh@ece.skku.ac.kr, jwjeon@yurim.skku.ac.kr

silee@yurim.skku.ac.kr, hrchoi@mecha.skku.ac.kr, hgchoi@yurim.skku.ac.kr

Abstract

Keyboards have been used on typewriters and as input devices to computers and many keyboards have been proposed in order to improve their performance. Some glove-based input devices to computers have been also proposed for compactness and flexibility. In this paper, an input device to computers consisting of a pair of gloves is proposed. The keys of the proposed gloves are mounted on the fingers of gloves and their chording methods resemble those of a Braille keyboard. Since the Braille representation for numbers and characters is efficient and has been well established for every language, the proposed input device may be one of good input devices to computers. Furthermore, since the Braille has been used for visually impaired people, the proposed one can be easily used as an input device to computers for them.

Index Terms – keyboard, chord keyboard, chord glove, input device, Braille

1. Introduction

Keyboards have been used both on typewriters and as input devices to computers. In order to improve their performance such as speed, accuracy, typist fatigue, comfort, and muscular strain, several keyboards have been proposed [1]. According to the development of small portable electronic products such as Personal Digital Assistants (PDA), cellular phones, and wearable computes, chord keyboards have been proposed as input devices of these small products [2-5]. In chord keyboards, the user presses multiple key combinations to enter an input instead of using one key for each character in a regular keyboard. Before the terminology of chord keyboards was introduced in the 1960's, Frank H. Hall invented the first Braille writing machine, Hall Braille writer, in 1892, which had one of the earliest chord keyboards.

Glove-based devices recognizing hand gestures or contact gestures directly have been proposed as input devices to computers [6, 7]. These devices are well suited for use in a mobile environment because the gloves can be worn instead of held and are lightweight and take up little space. However, it is difficult to recognize enough separate gestures to allow useful text input. In [3], a glove-based input device called the chording glove has been proposed in order to combine the portability of a contact glove with the benefits of a chord keyboard. In the chording glove, the keys of a chord keyboard were mounted on the fingers of a glove and the characters associated with all the chords, which is called the keymap, were designed to make fast discrimination reaction time (DRT). But it is quite difficult to design a good keymap for a given chording glove. Furthermore, it is not easy to make a new keymap become a standard one for a chording glove.

In this paper, a pair of Braille-based chord gloves is proposed. Each glove has seven keys. Three keys at the fingertips of each glove correspond to three dots in Braille. The characters associated with all the chords in the proposed chord gloves are designed in the same way as in a Braille keyboard, which was already established well. Since Braille is a faster recording medium, sighted people can efficiently use the proposed chord gloves after some training required in all chord keyboards. Furthermore, visually impaired people using a Braille keyboard can easily use the proposed chord gloves. In section 2, a pair of Braille-based chord gloves is proposed and implemented. In section 3, the characteristics of the proposed chord gloves are discussed.

2. A Pair of Braille-Based Chord Gloves

A pair of chord gloves as in Fig. 1 is proposed and each chord glove has seven keys. Three keys at the fingertips of each glove correspond Braille dots, of which the number is exactly same sequence as in a Braille keyboard. Other three keys perform the same function as pressing all three keys at the fingertips altogether, the

function of the space bar or the backspace bar, and the function of carriage return or enter, respectively. The other key at the little fingertip is reserved for future use. Therefore, the chording method in the proposed chord gloves is similar to that in a Braille keyboard, which has been already a standard for visually impaired people. Material for each key is polyvinylidene fluoride (PVDF) that generates a voltage when it is deformed. PVDF of the proposed chord gloves generates a voltage from 1V to 5V when each key is pressed. When each key is not pressed, the generated voltage of PVDF is zero. Since PVDF used for keys of the proposed chord gloves is bulky, it is difficult to press three keys at the finger tips altogether by the thumb while two of them can be easily pressed together. Thus, one key is added to perform the function of pressing three keys altogether. Other material that is thin and lightweight will be used in order to make it easily to press three keys at the fingertips altogether and its performance will be evaluated.

The voltage outputs of chord gloves are connected an embedded system that translates each chord information into its corresponding character or number. The output of this embedded system is connected to LCD displaying character or number and LED displaying five Braille cells. Also, the output can be connected to PC through an RS232C and the monitor of PC displays characters or numbers with corresponding Braille cell. Fig. 2 shows Korean Braille from the proposed chord gloves and its corresponding Korean sentence meaning "How are you?"

3. Discussion

Since the proposed chord gloves use two hands to input some characters or numbers instead of using one hand, it has some advantages over one hand chord keyboard, which include fast typing and low error rate [2]. Also, the proposed chord gloves have clear space advantages over both a regular keyboard and a chord keyboard [3]. Since the keymap for a pair of chord gloves proposed in this paper resembles the grade 2 Braille, it may take longer time to learn the keymap for the proposed chord gloves than to do keymaps in [2, 3]. However, after learning, the speed rate for text inputs by using the proposed chord gloves will be much higher than those of [2, 3] because Braille is a faster recording medium. Experiments of the proposed chord gloves are still in progress and the performance will be evaluated based on experimental results. Since the Braille codes for many languages in the world and special symbols including mathematics and music notations have been already defined, it does not need to design new keymap for them. Furthermore, the visually impaired people who have used a Braille keyboard can use the proposed chord gloves directly with no learning. Thus, the proposed chord gloves may help sighted and visually impaired people to

communicate and understand with each other even though sighted people usually see characters or number rather than touch and read Braille.

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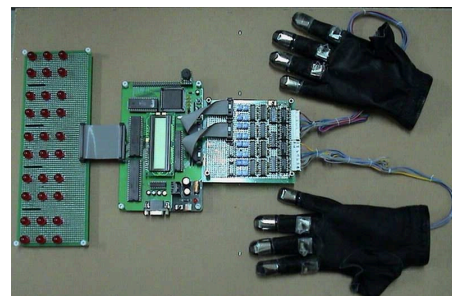


Fig. 1. A pair of Braille-based chord gloves.

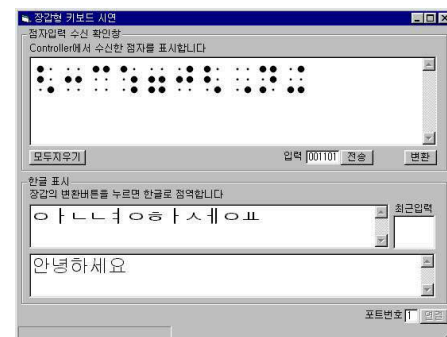


Fig. 2. Korean Braille and its corresponding Korean sentence.